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ABSTRACT

Intended to aid teachers, administrators, and interested parents by informing them about the state of the educational microcomputer market, this report is meant to be a guide to school districts in the acquisition and maintenance of microcomputers and related instructional materials. Trends in educational computing technology are noted in relation to market share, cost effectiveness, and technophobia. Also mentioned are teacher workstation considerations, computer software selection, management uses of computers, and recommendations of computers for instructional uses. (33 references) (DB)

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Instructional Microcomputer Report

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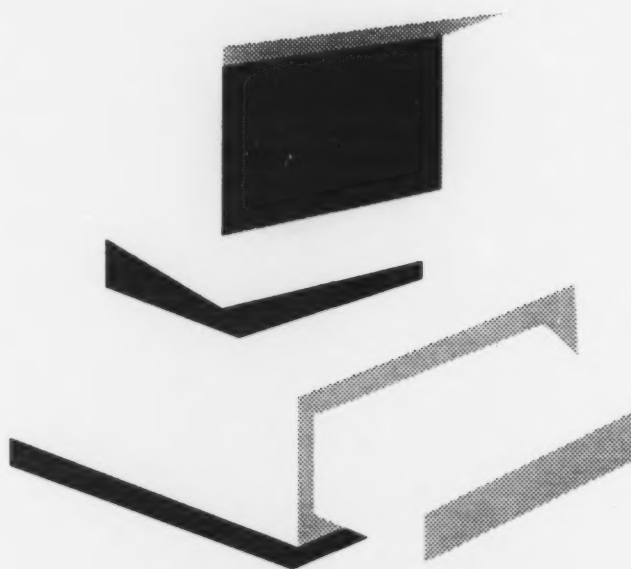
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by

B. R. Black, Ed. D.
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May, 1991



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FROM: ST Strato Telvely, Asst. Superintendent, Instructional Services
Ward Hurst, Director, Secondary Education
Betty Todd, Director, Elementary Education
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SUBJECT: Update on Instructional Computer Recommendations

In December, 1989, the Instructional Computing Office distributed a report of the various brands of microcomputers being used by schools together with an analysis of the microcomputer market and microcomputers then currently being recommended for purchase by schools. This past Fall, the microcomputer market exploded with the release of several new computers which greatly expanded the options available to schools. Rather than try to speculate on how the market would develop, the decision was made to prepare two reports for the 1990-91 school year. The first report, dealing with the number and distribution of microcomputers in schools, was distributed on December 10, 1990.

The attached analysis is the second phase of our annual effort to keep all schools informed about the state of the educational microcomputer market. Not many principals and teachers have the time or resources to study the educational computer market. This is our attempt to provide the district with our opinion of where the market is and where it may be headed. Where possible, references have been cited so that interested teachers and local computer contacts may look up the reference for further reading and form their own opinion.

The recommendations made in the report are exactly that—recommendations. But they are made with the understanding that our intent is to back up those recommendations with support. Computers that are not on the list may or may not be supported depending on a variety of unknowns which include manufacturer's willingness to support schools and provide information unique to educators, or it may reside around an issue as simple as the availability of spare parts from which the district can perform repairs at a considerable savings. Because the school district is dealing with public funds, there is an understandable tendency to be conservative with the public's educational dollar, particularly in the case of a number of "clones," computers which appear to be compatible with computers already being used in schools, but which in fact may not run software currently being recommended and used. For example, not all MS DOS compatibles have been certified to run Novell Netware. Several of the Apple clone computers and add-in boards do not run all Apple software. There is sufficient reason for caution to be exercised by schools.

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Several new Apple and MS DOS computers are being recommended for the first time. New models from Apple Computer Inc. bring new power to teachers and students with their ability to bring Macintosh features to instructional settings at lower prices while still maintaining their ability to work with older Apple IIe and MS DOS environments (see p. 14). New MS DOS computers are also being added (see p. 16). Both Apple and MS DOS changes are predicated on the need to update student and teacher computers to more modern graphic based systems which will support new multimedia technology being developed by Apple, IBM, Microsoft and others (see p. 6).

The instructional computing office has traditionally not wished to impose so-called "standards" which limit experimentation and growth. However, I wish to emphasize one of the recommendations which will follow. For those who wish to purchase an instructional MS DOS computer from this date, the minimum configuration recommended is with an i286 or Intel 80286 microprocessor, 1 MB RAM, high density 3.5" floppy drive (1.4 MB) and VGA (high resolution) monitor. Computers that meet this specification are available from recommended vendors, IBM, Northgate and Tandy. This level of computer is suggested as the "floor" for MS DOS purchases in the foreseeable future. I have asked the purchasing department to monitor microcomputer purchases to assist schools attempting to observe this recommendation. Schools or departments who choose to vary from this instructional recommendation to complete a lab already partially equipped have the latitude to do so and should simply be prepared to support their selection if asked.

This may be a good time to remind principals and school computer contacts to check for older, unserviceable computers that are no longer being used. Unuseable computers may be turned in for salvage. Many of the early Commodore and Tandy machines with limited memory and only tape drives are no longer economical to repair. If the computer is being used, by all means continue to use it. If the computer has become a museum piece sitting on a counter top as a bookend, it may be time to reevaluate the computer's usefulness to students.

And a final reminder as schools begin to think about summer, the Instructional Computing Office has consistently advocated a policy of allowing teachers to sign-out computers, printers and software for use over the summer months. Access to a computer and printer is a prerequisite for teacher participation in the Computer Applications sessions in the Summer Institutes. Schools should follow the same procedures for property accountability as for any other major piece of equipment.

More detailed information about specific hardware brands is available. If you have any questions about any of the topics discussed in this report, please contact B. R. Black, Supervisor of Instructional Computing (534-2267).

CC: Bob Williams, Director of Purchasing
Milt Brantly, Supervisor, Business Education

The 1991 Polk County Schools Instructional Microcomputer Report

by

B. R. Black, Ed.D., Supervisor, Instructional Computing

From the cowardice that dares not face new truth,
from the laziness that is contented with half-truth,
from the arrogance that thinks it knows all truth,
Good Lord, deliver me. Amen.

Prayer from Kenya¹

There exists a state of confusion among the rank and file. Claims and counter-claims are being made. Evangelists for several computer hardware brands speak out—dare I say “pro and con?” Surveys are completed, numbers are gathered and data reported as supporting one or more conclusions about which the average reader may know little, but certainly sound reasonable. Even the educational journals and magazines contribute to this uneasy expectation that somehow a cataclysmic transition is about to take place and the uninformed will be swept away in a flood of change.

The central dogma that technology using teachers and administrators must face every day is change. Educators are already used to that. Textbooks change and students change, but the rate of change in the technologies that influences how they teach on a daily basis accelerates each day. This report is an attempt to sift through some of the conflicting reports and advertisements, and to restore calm, if not serenity.

What the survey information shows

A variety of computer surveys are taken each year either at the request of vendors who wish to research current trends or independently by companies that in turn sell this information to others. Sometimes, it is very difficult to tell which type of survey is being done, if you are responding to such a request for data. When time permits, Polk County Schools responds to a variety of those survey requests each year.

The Instructional Computing Office also tries to monitor a variety of publications, with both educational and business orientations, to keep track of technology trends. For example, the following table contains several of the published reports of microcomputer trends over the last six months.

¹*The United Methodist Hymnal*, (Nashville: The United Methodist Publishing House, 1989), p. 597.

Table 1

Market Share Percentage by Brand

Brand	Overall Market Infocorp ²	Home Market Link Data ³	K-12 Schools Link Data ⁴	Florida K-12 DOE Data ⁵	Polk K-12 '90 Data ⁶
Apple	21%	20%	60%	53.3%	50.8%
Commodore		18%	2%	2.1%	12.7%
IBM	20%	16%	23%	20.3%	10.7%
IBM Clones		25%			
Tandy	12%	13%	9%	16.3%	22.8%
Compaq	8.2%				
All Others	38.8%	8%	6%	8.0%	2.5%

An interesting variety of numbers exists depending on which market the survey attempts to investigate. A similar variation can be found if the survey company by choice or even by accident only surveys a few districts and those districts have a particular tendency that is not representative of the state or nation. For example, a major computer company recently conducted a national survey of school districts to determine educational computing market trends. Whether by chance or by design, the only three Florida districts that participated in the national survey had already made a heavy investment in that one particular brand of computer. While the data may be quite accurate, the conclusions are certainly open to question.

One of the national surveys that Polk County has tried to support for a number of years is performed by Quality Educational Data (QED). The company has issued a number of national reports and is frequently cited by educational authors and district technology users as a source of information. The most recent QED survey was conducted in the Fall of 1990 and is summarized in Table 2. Because of recent product announcements made in October, the survey results reported in *BusinessWeek* included a disclaimer that the results may underestimate both IBM and Macintosh sales.

If we compare the QED data in Table 2 with the data shown in Table 1, differences exist between the two sets of information, but certainly an overall pattern is clear within the ranges of data shown in Figure 1 on page 4. There has clearly been growth in the number of MS DOS

²Laura Brennan, "Tandy Corp. Enhances Products To Thwart Recession's Effects," *PC WEEK*, April 8, 1991, p. 127-129.

³Laura Brennan, "IBM Channel for PS/1 Targets NEA Members," *PC WEEK*, February 4, 1991, p. 136.

⁴Robert McCarthy, "The Hardware Industry: MS DOS Makes Big Strides," *Electronic Learning*, April, 1991, p. 21.

⁵"Microcomputers in Florida Public Schools," *MIS Statistical Brief*, (Tallahassee: Florida Dept. of Education, January, 1991), p. 3.

⁶"The 1990 Polk County Schools Instructional Computing Survey," *Instructional Computing Update*, December 10, 1990.

computers used in education. There has also been growth in the number of Apple II and Apple Macintosh computers used in education. If you look at the market long enough, and read a sufficient number of sources, you may even find references to the fact that in February, 1991, Apple's retail market share grew to more than 20 percent, outpacing even IBM.⁷ Is that a fact? Yes. Is it significant? Only time will tell.

Table 2

Market Share - Educational Microcomputers

	85-86	86-87	87-88	88-89	89-90	90-91
Apple	55.0%	56.6%	60.6%	63.5%	63.7%	63.5%
IBM	5.1%	6.1%	8.0%	10.2%	12.1%	13.9%
Tandy	15.9%	13.3%	12.8%	10.3%	9.8%	8.3%
Commodore	12.6%	10.8%	10.1%	8.1%	7.2%	5.5%
Other	11.4%	13.2%	8.5%	7.9%	7.2%	8.8%

Source: Quality Educational Data (QED)⁸

Granted that computer hardware surveys should be taken only with large doses of salt, what about microcomputer operating systems? Everyone knows that older Apple IIe and MS DOS operating systems are based on outdated technology. Both systems use a system of abbreviated commands, the syntax of which must be typed into the computer accurately or the computer may take a newly created file into "never-never land." I suspect that more computer anxiety and hostility have been created by microcomputer operating systems than any other source of technophobia. For some time, computer operating systems have been around which have attempted to reduce the user's level of frustration and anxiety. But until recently, microcomputers were too primitive and operating systems too crude to allow some of the computing power resident within the box to be used to make the computer easier to use.

The computer's central processing unit (CPU) is part of the key to making a computer easier to use. As microprocessors have advanced from Z-80's to 8088's to 8086's to 80286's to the current 80386 chips, computers have been able to access more memory and to process each piece of information faster. The transition of computer design is usually compared to moving from a 4-lane street to an 8-lane highway to a 16-lane freeway to the present 32-lane super expressway. This advanced "32-bit" CPU capacity is what has led to the gradual development and use of interfaces which are considered "user friendly."

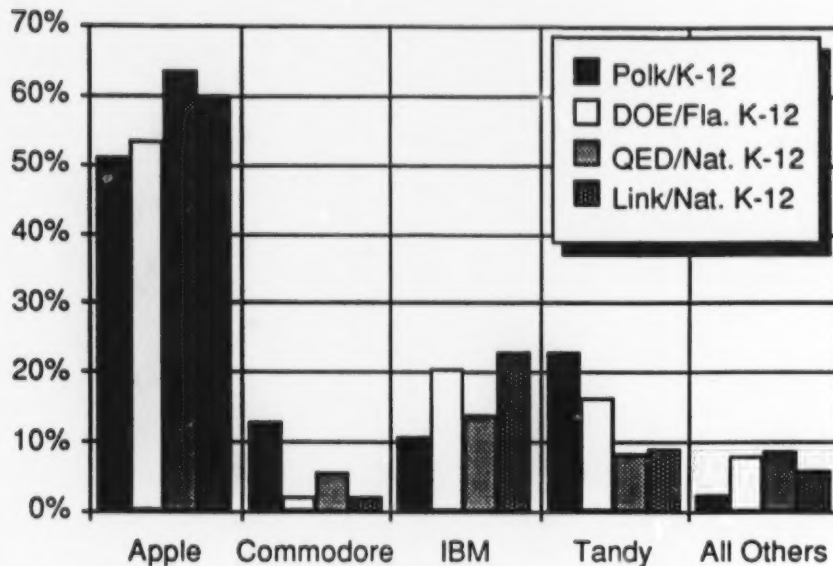
Although often over-sold by vendors and computer sales people, the concept of an easy to use tool to help normal people do extraordinary things is no longer an expensive dream. More robust computer chips such as Motorola's 68020, 68030 and 68040 have permitted the development of powerful UNIX workstations for even higher level applications. The Motorola

⁷Rachel Parker, "Windows 3.0 Threatens Apple, But Microsoft Could Be Big Loser," *InfoWorld*, April 29, 1991, p. 48.

⁸"High-Tech Have-Nots," *BusinessWeek*, December 10, 1991, p. 98ED.

microprocessor, is also a 32-bit chip—a 32-lane highway—that allowed more information to be processed even more quickly. Both the Intel and Motorola 32-bit computer chips have actually allowed computers to use part of their power to help users—without a significant penalty in cost and operating efficiency.

Figure 1
Comparison of K-12 Surveys - 1990-91



Many of the computer vendors have made significant strides in responding to customer dissatisfaction. Bud Tribble, Vice-President for Software Engineering at NeXT Computer Inc., admits a significant amount of computing power is being dedicated to users, "On the desktop today, 80% of computing power is going toward ease of use, such as menus, windows, and pop-ups. Only 20% is actually going toward doing the job, such as calculating your spreadsheet."⁹

Some of that understandable dread and apprehension about computers changed with the development of the "graphical user interface" (GUI) such as found on some of the original Xerox workstations, the Apple Lisa and the Apple Macintosh. Similar window and icon based interfaces are available on a growing number of Intel microprocessor based machines such as those from IBM, Tandy and others using Microsoft Windows 3.0. IBM developed a variation of the GUI called "Presentation Manager" which runs within its own proprietary operating system, OS/2. Even more powerful UNIX based workstations use a variation of GUI's called X-Windows. The purpose behind all of this activity centers on the need to develop easy-to-use computers.

⁹Bruce Nussbaum and Rober Neff, "I can't work this thing," *Business Week*, April 29, 1991, p. 58.

Dataquest, another one of the market analysts reported in the trade journals, estimates Microsoft Windows will ship more than 12 million units by 1995, more than quadruple its 1990 ship rate. If their predictions hold true, by 1995 Windows will control more than half of the overall microcomputer market, including UNIX-based systems. Apple's internal projections give the Macintosh a surprisingly strong 25 to 30 percent share of the microcomputer market by 1995.¹⁰

Add to this powder keg reports that Apple may rewrite the Macintosh operating system to allow it to operate on other types of computers and other chip architectures.¹¹ IBM's discomfort with their deteriorating relationship with Microsoft gives rise to news stories that Apple and IBM may be working behind the scenes to bring their two operating systems closer together.

"It's in their best interests to work together," said Ash Jain, editor of *The Macintosh Market Report* in Irvine, California. "What Apple lacks is an installed base. To bring the Apple OS and put it on IBM's hardware would make them directly competitive with Microsoft."¹²

While Apple has reduced prices and brought out additional low-cost Macintosh computers, Intel, the manufacturer of the chips normally found in most MS DOS computers, has announced the availability of the i486 chip, yet another bigger, faster, better microprocessor to be used by personal computers. As manufacturers begin to release versions of their computers designed around these higher level CPU's, many of the current MS DOS computers will migrate downward, eventually replacing the 8088 and 8086 computers as consumer machines.¹³ This has several implications for those interested in purchasing computers for business, educational or home use.

Computers don't seem to be getting any less expensive as much as computers are becoming faster and more powerful for the same price as before. As mid-level and high-level computers migrate downward, the cost per unit of memory and the cost per operating cycle continues to decline to the point that today's microcomputers are beginning to challenge yesterday's mini-computers and mainframes for sheer processing power. Thus, businesses and schools can afford to consider more powerful computers that will last until the end of the 1990's. Real computing power, with higher resolution graphics is affordable. It's time to consider moving educational computers toward a higher level of functionality found in full 32-bit computers and graphical user interfaces. Buying a computer should not be just an ordinary purchase; it should be an investment.

¹⁰Andrew Gore, "Is the Mac losing market-share war?" *MacWEEK*, March 19, 1991, p. 76.

¹¹Andrew Ould, "Apple Considering Non-Macintosh OS," *PC WEEK*, March 25, 1991, p. 6.

¹²Kristi Coale and Ed Scannell, "Recent Developments Point Toward New Odd Couple - IBM and Apple," *InfoWorld*, April 8, 1991, p. 101.

¹³Tuseda Graggs, "486SX Will 'Cannibalize' 386 Sales, Leave 386SX Market Strong," *InfoWorld*, April 8, 1991, p. 24.

The Implications of Teacher Workstations Available to Every Teacher

Alice Ray-Overstreet, Polk County School's Computer Curriculum Specialist, recently remembered an article which reported the experience of an Alaska school which established its own teacher workstation plan and network within their own school. She asked me to share the components used in the Alaskan school's concept of the teacher workstation with the Department of Education's Model Teacher Workstation Committee, a group currently working to examine the possibility of providing each teacher with appropriate technological resources. I should be careful to point out that these suggestions *do not* constitute the committee's official position, nor is there any certainty that these recommendations will find their way into the committee's final report. However, these suggestions have in fact been made to the committee for their consideration.

Workstation components listed by the Alaskan classroom teachers included:¹⁴

- A Macintosh on every teacher's desk.
- Software programs to run attendance, grading and other management tasks.
- A network plan to tie all of the computers together with the school office for the transfer of data.
- A central repository for all pertinent student data.
- Printer resources on the teacher's desk for parent letters and other written communications, as well as printing resources on the network for desktop publishing.
- Videodisc player and CD player capability in the network to allow for integrated-media lesson planning.
- Telecommunications capabilities to meet future needs as they arose.

Before being submitted to the workstation committee, the list of "wants and desires" developed by the Alaskan teachers in the Spring of 1988 was expanded and revised in light of technology brought about by three more years of change. A number of other sources were available from which to add comments and quotations to explain and expand the ideas embodied within the original Alaskan list. Any suggested changes to the original *T.H.E. Journal* text are shown in brackets.

Workstation Considerations

- A Macintosh [*an easy to use, "point and shoot" graphics based computer*] on every teacher's desk.

The 1988 Alaskan system was pre-Windows 3.0. Current choices would include Mac OS, Windows 3.0, OS/2 w/Presentation Manager, and a variety of UNIX/X-Windows formats. The point is that most teachers will need much more capability than a 3270 terminal and blank command line or even 30 menu items filling up the screen. The current DOS (MS DOS, DR DOS, or whatever) 80 character screen will handicap instructional applications within the *immediate* future.

¹⁴Skip Cox and Merle Arin, "A Computer on Every Teacher's Desk: Improving Teacher Productivity," *T.H.E. Journal*, Macintosh Special Issue, 1989, pp. 48-51.

It may not be immediately clear that the everyday users of computer systems are the ones who require the most powerful systems, with the most memory and the best displays. Professional programmers can get by with less, for they know how to deal with more complex interactions and less effective displays.¹⁵

Training for users should be built into the computer and into the operating system itself. Of course, specific applications training, tutorials and help screens should be built into the individual software applications purchased. This need goes beyond just applications. The initial *hardware* training for each user should be an easily accessible component within the computer's regular operating system and available to any computer user as soon as the computer is purchased and installed.

From a July, 1989, survey of 1000 teachers: For 68 percent, lack of resources—money, computer hardware and software, and building space—was the principal cause of computer ineffectiveness. Lack of proper training was an obstacle cited by 38 percent of interviewed teachers.¹⁶

Hardware and operating software are just the beginning of the costs at large corporations. While hardware accounts for 15% of total cost of owning a PC over a three-year period, software takes up 15% and providing access to mainframe and minicomputer data another 10%. A whopping 50% comes from support and training. "The main component is personnel and support," he says, adding that those are "costs that don't go down every year."¹⁷

Current corporate standards (in most places) include a set of character-based—that is, hard-to-learn—software packages. While many users have mastered the basics of these tools, few have become craftsmen.¹⁸

- Software programs to run attendance, grading and other management tasks.

Graphics based "touch screen" or mouse-driven attendance reporting can be demonstrated now. Linkage to other packages can be arranged given the usual prerequisites, time and money. The committee's recommendation should promote the concept that teachers (the actual users) should be entitled to have input into the selection of the package to be used...as opposed to edicts issued from the "crystal palace."

¹⁵Donald A. Norman, *The Psychology of Everyday Things*, (New York: Basic Books, 1988), p. 181.

¹⁶"Teachers Give Computers Mixed Reviews in Recent Survey," *Education Monitor*, December 12, 1989, p. 1.

¹⁷Ron Evans as quoted by Will McClatchy, "Keeping PC Costs Down to Earth," *InformationWEEK*, Sept. 4, 1989. pp. 12-13.

¹⁸Cheryl Currid, "Users Need More Training Before Leaving the Nest," *PC WEEK*, October 22, 1990, p. 143.

Micro managers don't have a choice. Trying to stop the new wave of graphical user interface products is like trying to stop the clock.... The simple truth is, users will get what users want. Especially when it is something that works. Stand in the way, and you're history.¹⁹

There are exceptions, but we perceive it as all or nothing, to really get the benefits out of the graphical environment. If you're constantly flipping between character-based and graphical environments, you're losing a substantial percentage of the advantage of going to a single interface. Where we can, we're pushing people to go all the way.²⁰

- A network plan to tie all of the computers together with the school office for the transfer of data [*and exchange of files*].

An area of critical concern will be the ease of use related to the setup and administration of the actual school network. Some networks are easier to administer and some networks are easy to operate if networking was considered during the design of the computer and interface. Again, a visual, graphic representation of the tasks and network organization will assist the untrained and uninspired in keeping track of user moves and new staff members added to the network. This is a major task and should not be "glossed over" by vendors nor administrators with little practical experience in setting up and operating a network.

As far as I'm concerned personal computing ended around here last year when the network went up. We don't run it, it runs us. It sucks up my memory the minute I turn on my PC; it flat slows me down. ...The #@&% network turns my machine into an autistic terminal!²¹

The issue of "standards" will not be resolved by the teacher workstation committee. The fact that a variety of so-called "standards" already exist and are freely ignored by vendors, corporations, government and individual users alike supports the contention that the whole infrastructure of information technology managers, (CIO's, MIS, data processing, instructional technologists) should take all the necessary steps to support a multi-vendor, multi-protocol environment for the foreseeable future. Professionals will normally seek out the best tools for their work. No one software, hardware or communications standard exists that supports *all* the activities involved in instruction and instructional management.

Standardize and you simplify lives: everyone learns the system only once. But don't standardize too soon; you may be locked into a primitive technology, or you may have introduced rules that turn out to be grossly inefficient, even error-inducing. Standardize too late and there may already be so many ways of doing the task that no international standard can be agreed on; if there is agreement on an old-fashioned technology, it may be too expensive to change.²²

¹⁹Cheryl Currid, "He Who Ignores the GUI Is Doomed to Obsolescence," *PC WEEK*, July 9, 1990, p. 111.

²⁰Karl Thornton as quoted by Robin Nelson, "Putting on the Right Face," *InformationWEEK*, November 12, 1990, p. 38.

²¹Robin Nelson, "What's Your Net Worth?" *Personal Computing*, January, 1990, p. 57.

²²Donald A. Norman, *The Psychology of Everyday Things*, (New York: Basic Books, 1988, p. 202.

Today, in spite of the PC standard's dominance of the market, we're noticing a return to the era of battling standards. Why? Because the current standards don't take full advantage of the technology, nor do they address all the needs of today's users.²³

- A central repository for all pertinent student data.

As mentioned at the teacher workstation meeting hosted by McDonald Douglas, the transfer of text, or even graphics, no longer constitutes a major problem. While more than one vendor promises "seamless" distribution of data over the network so that the user no longer cares where the data is stored (a somewhat vaporous concept in practice), the issue of who "owns" the data and the "costs" related to data access will still be a volatile issue for years to come.

Pogrow (1985) reported that "highly centralized administrative systems have traditionally simplified work in the central office while increasing paperwork at the school level." This is likely the natural result of priorities set by central staff, however, such systems work hardships on campus users. The solution would seem to reside in distributed processing systems that utilize microcomputers as "smart" terminals and share central databases, but are able to work independently of the central system when necessary.²⁴

- Printer resources on the teacher's desk for parent letters and other written communications, as well as printing resources on the network for desktop publishing.

Teachers are in the "publishing" business. In recent years the quality of teacher-generated printing has fallen behind that which is available to business. We "are" what we send home with Johnny sometimes.

- Videodisc player and CD player capability in the network to allow for integrated-media lesson planning.

Teachers need access to "easy to use" workstations that can control and manipulate these instructional devices in their own room as well as on the network. Teacher developed instructional software is not the issue any more than teacher programming was a "real issue" in the early 80's. The power of the teacher workstation will be in the ability to easily pre-program or "repurpose" a variety of instructional devices for use "on-the-fly" and to easily manipulate these complex devices to support student-teacher-interaction with the knowledge base. A variety of software products is available to assist this, but HyperCard appears easier to use and more powerful than Linkway, Toolbook, Plus and others.

²³Michael J. Miller, "From the Editor," *InfoWorld*, October 8, 1990, p. 66.

²⁴Robert S. Randall, "Human Change: A Problem During Design of Computing Systems," *Journal of Research on Computing in Education*, Winter, 1989, p. 163.

Over the past few months, I've been reading futurists' projections from earlier times—at the turn of the 20th Century, at the 1939 New York World's Fair, the post World War II era—and I've been struck again and again by one failing: Those seers almost always underestimated both the rate and extent of change, seeing the future as more of the past, if only bigger and faster.²⁵

- Telecommunications capabilities to meet future needs as they arose.

Each teacher, as a responsible professional, should have immediate access to a telephone. With telephone access, modem access to remote databases is not only possible, it is desirable so that teachers and students can have access to the growing knowledge base. This would also allow distance learning opportunities with on-line voice or data exchanges with remote instructors.

Finally, as my only contribution to the Alaskan list of components, I would also add:

- Teachers need access to a similar workstation system at home.

Much of the teacher's "work" is not done at school. The truly revolutionary will urge districts to help teachers purchase computers through payroll deduction, special bulk prices and other options. The assertive will soon demand access to the school or district network from their home soon after they discover that modems are easy to use. Possible solutions include the use of portable computers (weight not to exceed 5 to 7 lbs.) that "dock" into teacher desktop stations already connected to the school network. This would also assist teachers with shared classrooms or several classroom assignments. Otherwise, teachers will need to carry the workstations home.

I concluded my suggestions to the workstation committee with the following, "I hope this brief commentary will provide some basis for committee discussion leading to the members coalescing around a set of general teacher workstation concepts that can be published with the August committee report for additional input from districts over the 1991-92 school year, and eventually leading to development of a comprehensive state level workstation plan by the end of 1992."

Instructional Decisions and Other Practical Matters

Given the need for teachers and administrators to have access to more powerful computers to meet the growing needs of students and to bring new technologies into the classroom, what factors should drive purchase decisions regarding instructional computers? The same considerations that have been discussed for years.

The Instructional Computing Office continues to suggest the following three step process for making decisions about the purchase of computers and other forms of technology:

²⁵Jim Seymour, "Don't Underestimate the Rate of Change in the '90s," *PC WEEK*, January 8, 1990, p. 11.

1. Write down what you want to do or accomplish. That's right. Write it down. The process of writing seems to solidify the person's thinking as to what is important and what may be less important.
2. Find the best software that accomplishes what you want to do. Several methods are available to find the best software. Some of those methods include: recommendations from other teachers in your subject area, participation in subject area meetings and conferences, educational publications, on-line searches, and if at all possible, test drive or preview the software before actual purchase.
3. Finally, find the best hardware you can afford to run the chosen software.

Consumer Reports has enjoyed a reputation for cutting through all the hype and advertising. Many educators subscribe to the magazine and depend on its advice to purchase a variety of products. *Consumer Reports* suggests the following seven step process before making computer purchases:²⁶

1. Become computer literate.
2. Learn what is available.
3. Thoroughly assess your needs.
4. Select your software.
5. Select your hardware.
6. Buy intelligently.
7. Use, maintain, and care for your investment.

If the educational purchase decision is driven by instructional considerations, as it should be, the next question to be examined is the direction of the educational software market. Two helpful reports have been recently released that provide some hint as to the direction taken by software developers.

Only the Best: The Annual Guide to Highest Rated Educational Software, Preschool-Grade 12 is a respected publication which includes only the highest rated software titles in its annual publication. Of the 183 programs included in the 1991 edition, the following percentages were observed:

Apple II -	74%	A significant decline from Apple II's 99% rating in 87-88.
Apple IIGS -	9%	
Macintosh -	15%	Up from 10% last year.
MS DOS -	35%	No gain since last year.

(The total exceeds 100 percent because some programs run on several different types of computers.)

It may be of more than just passing interest to note that "Where in Time Is Carmen Sandiego" obtained more high ratings than any other program. Runners up included "Math

²⁶Olen R. Pearson, *Personal Computer Buying Guide*, (Mount Vernon: Consumers Union of U. S., Inc. 1990), p. 3.

Cost: \$10.95 plus \$2.50 shipping. Copies are available from:
 Consumer Reports Books
 9180 LeSaint Drive
 Fairfield, OH 45014-5432
 Phone: 513/860-1178.

Blaster Mystery," "McGee" (A Macintosh early learning package) and "Learning About Animals." The software publishers with the most programs in the 1991 publication were MECC with 22 titles on the list and Sunburst with 21.²⁷

While Apple IIe's drop in *Only the Best*: titles fell from 99 percent in 1987-88 when Apple practically "owned" the educational software market, to only 74 percent in the current year, the decline doesn't give much credibility to statements by IBM's supporters that there is more quality educational software available for MS DOS than for Apple. Educational MS DOS titles still outnumber the Macintosh titles, but the percentage of quality MS DOS titles as listed by *Only the Best* has shown no growth over the past year.

A special *Electronic Learning* spot survey of 11 of the top stand-alone educational publishers revealed, "Despite the increasing presence of MS DOS and Macintosh computers in schools, 72 of these new [162] titles will be for the 5.25-inch Apple IIe hardware platform." Twenty-seven of the 162 new titles will run on the IIGS. The article continued, "The number of MS DOS titles is high, with 54 new programs being released for the 5.25-inch and 3.5-inch platforms., ...Thirty-six new titles for the color Macintosh will be released this year, as well as 26 color Mac versions of titles previously released for other computers."²⁸

According to my calculations, that seems to indicate more new educational titles will be released for the Macintosh than new MS DOS educational titles this year - 62 Mac to 54 MS DOS. Regardless of the statements by hardware vendors to the contrary, there still seems to be a viable educational software market for a variety of hardware platforms.

Even in the business software market where MS DOS software dominates with over 90 percent of the market, development of MS DOS software and OS/2 software has declined. In a survey of the top 100 software companies and reported in *Soft•letter*, Windows development grew from 25 percent in 1990 to 31 percent in 1991. Macintosh development also grew from 50 percent to 54 percent.²⁹

Yes, there has been growth in Apple II, Macintosh, MS DOS for education and Windows. However, the evidence seems to be that software developers who gamble "real dollars" on the direction being taken by consumers every day have not yet abandoned the Apple platforms. New software, and highly rated educational software is still being written for both Apple platforms as well as for MS DOS machines. The Florida Department of Education's instructional software acquisition program also supports a variety of microcomputer platforms and media formats. The 1991-92 Instructional Strategies Enhancement purchase program will provide 58 titles and include CD ROM and laserdisc titles for the first time.

²⁷Daniel E. Kinnaman, "Only the Best in Educational Software," *Technology & Learning*, November/December, 1990, p. 8.

²⁸Therese Mageau, "Ile Titles Dominate," *Electronic Learning*, February, 1991, p. 6.

²⁹Steven Burke, "Support for OS/2 Drops; Windows Is on the Rise," *PC Week*, May 13, 1991, p. 148.

Recommended Instructional Computers

As stated in the 1989 recommendations, "The Instructional Division, and the Instructional Computing Office remain reluctant to specify a 'standard' computer. The feeling of some individuals that a single computer standard must be mandated is offset by an equally large and vocal group that feel that so-called 'standards' are quickly obsolete, that adoption of up-to-date technology is obstructed, legitimate educational opportunities cannot be pursued, and individual creativity and productivity is inhibited."³⁰

Based on the instructional software and hardware being purchased across the nation, there is little reason to make drastic changes in the recommendations for school purchases. The following computers appear to have sufficient numbers of local dealerships and/or corporate level service and support to be of instructional use for the next several years.

Apple ProDOS and Macintosh Systems

Apple IIe or IIc Plus

All instructional uses K-12 where appropriate subject area software is available.

Keep in mind that the basic Apple IIe/IIc design is 12 years old. This is an antique computer by almost any standard of measurement. All the more remarkable is that despite its age, both hardware and software companies still find new and exciting things to add to the machine. The simple, easy to use design and durability have made it a classroom favorite for many years. Schools may wish to continue to purchase this computer for use with the software provided by the district's MECC site license. However, the architectural design is beginning to show its age.

Apple IIGS

All instructional uses K-12 where appropriate subject area software is available.

This machine requires special consideration. The IIGS is basically a machine which mixed the older IIe internal simplicity with new graphics software and a graphics-based user interface. The resulting compromises have taken their toll. The Apple GS/OS 16-bit operating system is slowed by the need to handle graphics. The machine is also slower operating on a network than its IIe cousin. However, many of the IIGS specific applications demonstrate breathtaking use of high resolution color graphics. The availability of HyperCard for the IIGS will probably extend the life of the IIGS machines by allowing teachers to use educational HyperCard stacks originally developed to control CD ROMs and laserdiscs using Apple's Macintosh. Schools should have particular IIGS applications in mind prior to purchasing this machine.

³⁰B. R. Black, "Instructional Computing Survey," (Bartow: School Board of Polk County, December 4, 1989), p. 14.

Apple Macintosh (Classic, LC, SE/30, IIsi, IIfx, and IIfx)

All instructional uses K-12 where appropriate subject area software is available.

The growth of high quality and easy to use software for this machine continues to accelerate as prices decline and the user base expands. Many myths have developed about this unique machine. It was one of the first machines to take special advantage of computer graphics to prepare on the computer's screen what would eventually be seen on the printed page. This machine also defined the graphical user interface for millions of users. Other less favorable myths developed. For example, myths still circulating include:³¹

- Macs aren't affordable.
- Macs don't have relevant software.
- Macs aren't compatible.
- Macs can't connect.

The current round of competitive price cuts and new lower cost machines have started to refute the price myths. Education software as well as a wide range of business and scientific applications extend the machines' usefulness in educational settings. Most new Macintosh computers with the appropriate additional software and memory cannot only read MS DOS data disks, but can run MS DOS programs in a Macintosh window while maintaining its normal compliment of Macintosh applications running simultaneously. The Macintosh is powerful enough to emulate an MS DOS computer in software, without additional hardware boards. And finally, Macintosh computers can connect to almost any computer system in current use. The barriers to Macintosh connectivity are more mental than physical.

However, do not be deceived into thinking that using a Macintosh takes no effort at all. Like any computer, learning a Macintosh will take time and some effort. According to several investigations, it will just take less time and less effort compared to more primitive character based computers. In one such study performed by Temple, Barker & Sloane, Inc., graphics-based computer users reported less frustration and increased productivity—up to 78 percent more productivity than character based computers at similar mixed exercises.³²

The Macintosh LC with an additional \$125.00 card has the ability to run both Apple IIe software as well as Macintosh software. Be aware that IIe software on 3.5" disks will load from the Macintosh 3.5" Superdrive. A 5.25" disk drive port is located on the IIe emulator card to allow users to attach a 5.25" drive to load programs directly from the larger, original MECC 5.25" disks. Schools considering purchase of a IIGS may want to carefully consider the color LC as an optional choice if similar applications are available for both machines.

The Macintosh SE/30 is the same compact size as the Macintosh Classic but uses a much more powerful CPU. This machine is ideal for a small semi-portable machine and can be used as a fast fileserver to operate a network where a color monitor is not required. Other machines, such as the IIsi, IIfx, and Macintosh portables are either faster or more specialized computers. The use of a particular computer should balance a number of factors: the proposed

³¹Andrew Gore, "Apple takes aim at anti-Mac myths, targets IS with marketing campaign," *MacWEEK*, April 2, 1991, p. 71.

³²Lisa Day-Copeland, "Clinical Research Finds PC Users Are More Productive with GUI Interface," *PC WEEK*, July 23, 1990, p. 142.

application, instructional benefits, increased productivity, as well as the initial cost and reoccurring costs for training and maintenance.

MS DOS Computers

IBM PS/2 Models 30-286, and higher models.

All instructional uses K-12 where appropriate subject area software is available.

Tandy 2500XL/2 and higher models.

All instructional uses K-12 where appropriate subject area software is available.

For those who wish to purchase desktop MS DOS computers, the minimum configuration recommended is with an i286 or Intel-type 80286 microprocessor, 1 MB RAM, high density 3.5" floppy drive (1.4 MB) and VGA (high resolution) monitor. Computers that meet this specification are available from both recommended vendors, IBM and Tandy. This level of computer is suggested as the "floor" for MS DOS purchases in the immediate future.

Schools or departments who choose to vary from this instructional recommendation to complete a lab already partially equipped, should be prepared to support their selection. The purchasing department has been asked to monitor microcomputer purchases to assist schools attempting to observe this recommendation.

Multimedia PC's will soon be available from Tandy and other vendors. These machines will meet Microsoft's base-level multimedia specifications. Each will include a built-in CD ROM drive, digital and analog audio capabilities, Windows 3.0 with multimedia extensions, additional RAM and larger hard disk drive at prices that range from \$250 to \$800 more than similarly configured non-multimedia MS DOS computers.³³

Many schools and teachers wishing to work with MS DOS computers and applications that support the use of graphical user interfaces will want to consider Intel 386SX or 386 based computers with 2MB to 4MB of RAM, VGA monitors and 40 to 80MB hard disk drives. While users can gain several advantages similar to those discussed for the Macintosh by using Windows 3.0, users should review the system requirements of Windows 3.0 with the dealer before purchase and installation. Several of the Windows applications are quite large and require additional memory and disk storage space. However, once the graphics applications are loaded, operation is normally quite simple. What doesn't make much sense is constantly switching between Windows applications and ordinary MS DOS applications. Ease of use issues and productivity gains are quickly nullified by "flipping" between a mixture of Windows and regular MS DOS operations.

Northgate Slimline 286 and Slimline 386SX.

All instructional uses K-12 where appropriate subject area software is available.

These computers may be purchased under the provisions of District Contract 124-PC-1201. (See page 36 of district contract guide for detailed information and prices.) As this report was being prepared, the Instructional Computing Office was notified that arrangements

³³Nico Krohn, "Tandy Takes Low-Price Route," *InfoWorld*, May 6, 1991, p. 1.

had been concluded for local installation and setup of Northgate computers. Additional Northgate models may be added and recommended for instructional purchases as soon as new computer contracts are negotiated in June, 1991. The Instructional Computing Office will monitor the progress of this additional brand and send updates to schools as warranted.

MS DOS printers are available from a variety of sources. Generally, any of the printers on the current IBM or Tandy price list are acceptable and parts are available for repair. Keep in mind that printers recommended by the current version of the administrative microcomputer guidelines have been selected with an eye toward durability and ease of repair. Printers on that list exceed acceptable levels of performance for classroom use with MS DOS computers.

Laptops and portables have not been included as a specific recommendation. Many opportunities are developing for both teacher and student use of small portable computers. Several districts in Florida are allowing students, parents and teachers to check computers out overnight, over a weekend, or over an extended period of time for specific projects. Polk County's Chapter 1 Office operates a "Take Home Computer Program" for elementary students and their parents. At J. I. Leonard High School, a model technology school in Lake Worth, Florida, portable computers are checked out like library books. Schools considering the purchase of laptops or small portable computers for instructional applications should contact the Instructional Computing Office for the latest recommendations and prices.

Summary and Conclusions

All of the issues covered in this report to schools hinge on the accelerating rate of change. The knowledge base needed to make informed decisions continues to expand and change at an ever increasing rate. In this environment, it is difficult for teachers, administrators and interested parents to stay current with the computer market. I hope this report will stimulate each reader's interest and his or her determination to learn more about the various types of computers and other emerging forms of technology. This report only scratches the surface.

The best advice that I can give, free of charge so each reader will get what they pay for, is not to rush into any purchase decision. Information on quality educational software and appropriate hardware is available for the asking. Volumes are published on computers and computer applications each month. If teachers and administrators do their homework before completing the order, the odds are that their well-considered choice will be the correct choice for their school and their students.

Finally, the Instructional Computing Office wants to provide quality support for all applications of instructional technology. Please call 534-2267 or 534-2468 if you have any questions about the information provided in this report, or need additional assistance with the selection of instructional software or hardware.